WHY EXPLORE THE SUN?

- **Because the Sun is our nearest star!**
- **Solar Activity affects us on Earth! Coronal Mass Ejections (CMEs) can damage electronics and communications on the ground and satellites in orbit!**
- **To discover the dynamics of how the Sun works!**

The Sun

Our Nearest Star!

- ***The source of most of the heat and light for life on Earth.***
- ***109 Earths would fit across the disk of the Sun.***
- ***The interior of the Sun would hold about a million Earths.***

The Future

The mission to the Sun represents not only innovation in technology and science, but a challenge to our imaginations as well. Students, teachers, engineers, and scientists are collaborating in this exciting endeavor.

Other Sun Resources

Visit Solar Probe's Home Page:
http://umbra.nascom.nasa.gov/spd/solar_probe.html

Find out about Ulysses, orbiting the Sun's poles:
http://ulysses.jpl.nasa.gov

The European Space Agency (ESA) orbiter, SOHO, has new images of the Sun, daily:
http://sohowww.nascom.nasa.gov

For further Solar Probe Information

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Artwork by Kurt Wenner

OUTER PLANETS/SOLAR PROBE PROJECT

Solar Probe is part of ***Outer Planets/Solar Probe Project***, a multimission approach to Solar System exploration. Scientists and engineers are designing small, inexpensive, *smart* spacecraft, science instruments, avionics, and ground systems for a variety of Solar System destinations.

EDUCATIONAL OUTREACH

Outer Planets/Solar Probe Project has made significant strides toward making space exploration more accessible to everyone. Educational outreach efforts have directly involved hundreds of college students from universities all over the country in hands-on roles working on designing the mission. Many hundreds of teachers have attended teacher enhancement workshops sponsored by the Project. Thousands of K-12 students have participated in ***Outer Planets/Solar Probe*** Project educational programs.

The ***Outer Planets/Solar Probe Project*** Educational Outreach Program has developed a series of curriculum guides containing innovative exercises to enhance educators' efforts to teach space science to students of all ages.

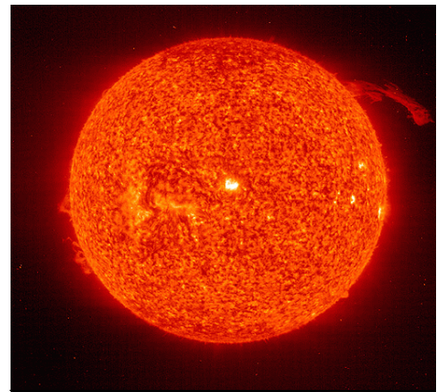
In one activity, students become living components of the Sun, the solar wind, Earth, and Earth's magnetosphere to demonstrate the dynamics of how the solar wind works. In this way, students and teachers alike obtain a direct experience of scientific explanations.

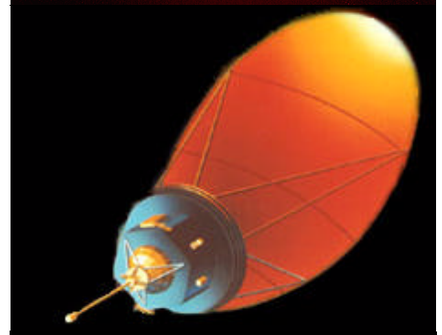
These research-based teaching strategies encourage both *critical thinking* and *kinesthetic* approaches, engaging body and the mind in ways that allow students to *live* the learning experience, develop an intuitive grasp of space science concepts, and encourage an attitude of life-long learning.

OUTER PLANETS/SOLAR PROBE PROJECT

Ice and Fire MISSIONS

Solar Probe: Mysteries of the Solar Wind!





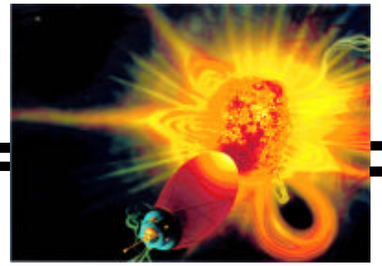
Solar Probe represents a dynamic and challenging scientific mission, and it also represents a means to motivate the human spirit to achieve the best it can offer and to gain perspectives that can help us better appreciate our nearest star--our own Sun.

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL 400-763 6/98

The Jet Propulsion Laboratory (JPL), California Institute of Technology, manages the Outer Planets/Solar Probe Project for the National Aeronautics and Space Administration (NASA).



Why Explore the Sun ?

Mission Objectives

- Measure the birth and acceleration of the solar wind
- Measure the heating of the solar corona
- Detect waves and turbulence inside the solar corona
- View the poles of the Sun up close for the first time
- View the Sun with the highest spatial resolution ever (20 km or 12 miles)

QUESTION: What do we know about the Sun and the Solar Wind?

Our nearest star, the Sun, is a powerful nuclear furnace radiating intense streams of photons, particles, and waves in all directions at high speeds.

We see direct evidence of the solar wind when comet tails stretch *away* from the Sun, both coming and going. Eugene Parker at the University of Chicago first theorized about the solar wind in 1958. Measurements from early spacecraft missions confirmed the existence of the solar wind by 1959.

Since then, scientists have observed super-hot temperatures in the solar atmosphere or corona, where it is believed that the solar wind begins.

—No one has ever sent a probe directly into the corona of the Sun.

QUESTION: What does the Solar Wind mean to us back on Earth?

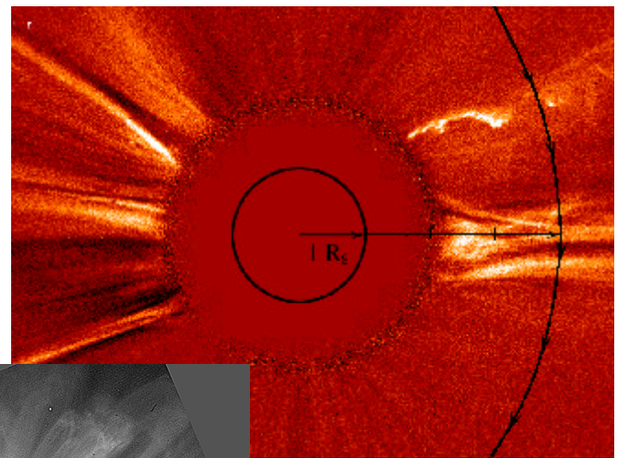
Scientists hope to learn how the solar corona gets so hot and how the Sun accelerates its solar wind. The solar wind travels outward from the Sun in all directions, moving throughout the Solar System and interacting with planetary magnetospheres, producing aurora effects and other disturbances such as disrupting radio communication on Earth and damaging the electronics in satellites orbiting Earth.

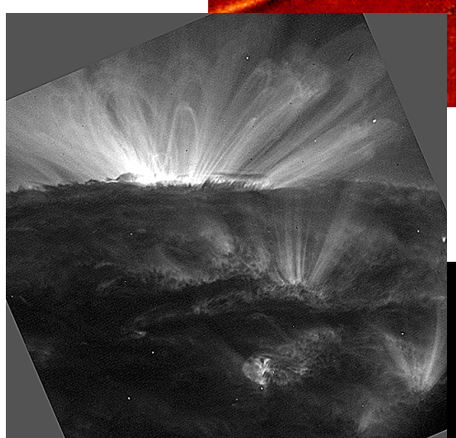
—The Solar Probe would approach as close as 3 solar radii (about 2 million km or 1.25 million miles) from the surface of the Sun with a heat shield designed to withstand temperatures of about 2300 K (3700° F) to enable science instruments to measure the close-up features of our nearest star, send the data back to Earth, and stay cool!

QUESTION: What features of stars can we see and describe? Can we learn about the structure of stars by observing our own star close-up?

POLAR VORTICES! Images from the *Solar and Heliospheric Observatory* (SOHO, the European Space Agency's orbiter that observes the Sun), show that the Sun's polar regions (75° latitude) have mysterious vortices that solar scientists do not understand.

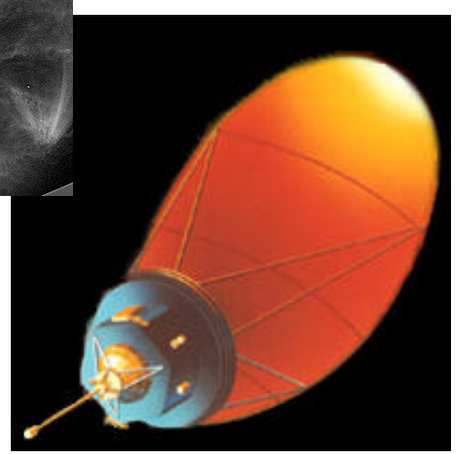
—Solar Probe will carry out a helioseismology experiment which will probe inside the polar regions of the Sun to study these vortices at almost 20,000 km beneath the surface.





POLAR PLUMES! Mysterious plumes arise out of polar coronal holes. These extend to altitudes of at least 30 R_S (30 solar radii, about 20 million km or 12.5 million miles) above the Sun and last for days. NASA's recent *Transition Region and Coronal Explorer* (TRACE) images demonstrate dramatic solar structures.

—Solar Probe will fly right through these tall, relatively thin structures to determine what they are.



SOLAR PROBE SCIENCECRAFT

The current version of the *Solar Probe* spacecraft would weigh (at launch) about 250 kilograms (about 550 pounds), making it a part of the new generation of microspacecraft. Nearly every part of the spacecraft represents a new generation of advanced technology. This vehicle will be unlike its predecessors, where science instruments were attached onto a pre-existing spacecraft bus and interfaced with the main computer. On *Solar Probe*, there is no such distinction. The integrated sciencecraft will cost less, have lower mass, and be easier to operate from Earth than previous inner Solar System spacecraft, and will provide the first close-up *in-situ* observations and images of the Sun.

SOLAR PROBE MISSION

The Sun is our nearest star. The solar corona is the primary destination of a proposed Sciencecraft mission being developed for NASA by scientists and engineers at the Jet Propulsion Laboratory (JPL).

The trajectory to the Sun is designed to pass over its poles. This is to ensure passage over the large polar coronal holes to take close-up pictures. This will also enable *Solar Probe* obtain *in-situ* observations of coronal heating processes and perhaps solve the mystery of the rapid acceleration of solar wind plasma!

During its closest encounter with the Sun, the *Solar Probe* will transmit its data to NASA's Deep Space Network. Scientists hope that this critical data will reveal the processes acting in the Sun's atmosphere.

Will we find the secret that makes the solar wind blow?